

Spinal deformities in tall girls

In a prospective study, 62 girls who consulted the paediatric department because of tall stature were examined for spinal deformities. Thirteen cases of scoliosis measuring 10 degrees or more were found. Eighteen girls had a thoracic kyphosis of more than 40 degrees and 11 had additional vertebral abnormalities indicating Scheuermann's disease. The incidence of scoliosis and Scheuermann's disease was much higher in our material than normal.

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A relationship between growth and scoliosis was observed by Bampfield as early as 1824. Willner (1974) found that patients with idiopathic scoliosis were taller than healthy controls, and Skogland & Miller (1980) found higher blood levels of growth-promoting hormones in girls with idiopathic scoliosis than in age-matched controls. Furthermore, Skogland & Miller (1981) observed altered growth patterns of the spine in children with idiopathic scoliosis. However, no data about the frequency of scoliosis in populations of different stature have yet been published.

We have studied the incidence of scoliosis and abnormal thoracic kyphosis in a group of tall girls.

Patients and methods

In a prospective study during 1979–1982, 62 consecutive girls with tall stature were examined at Sophies Minde Orthopaedic Hospital after having been referred to the paediatric department of Rikshospitalet, Oslo, for possible oestrogen treatment. The girls were 9–18 years old and their body height exceeded the mean for Norwegian girls by more than 2.5 standard deviations. The final height was predicted according to Baylay & Pinneau (1952). After paediatric evaluation, 51 of the 62 girls started oestrogen treatment; four of them started the treatment before the orthopaedic examination.

The orthopaedic examination included the forward-bending test, and examination of leg-length discrepancies and body height. A standard radiographic examination with frontal and lateral projection of the complete thoracolumbar spine was carried out with the patients in the standing position. A

single radiogram of the left wrist was made to determine the skeletal age, using the Greulich & Pyle (1970) standards.

Every lateral curvature of the spine was measured, and the occurrence of an asymmetry of the pedicle-shadow offset was recorded as vertebral torsion. All curves were measured by two investigators independently; in cases with different results, the mean values were used. The thoracic kyphosis was measured on the lateral films, and additional vertebral abnormalities which could indicate Scheuermann's disease were recorded as well; the criteria for this diagnosis were identification of three adjacent vertebra with wedging of 5 or more degrees (Sørensen 1964) combined with Schmorl's nodules, irregular end-plates and a kyphosis of more than 40 degrees.

A follow-up examination was carried out after 1 year or sooner if a progressive scoliosis was suspected. In some cases the findings indicated that follow-up should continue for an additional 1–2 years.

Results

A scoliosis curve measuring 10 degrees or more was found in 13 of the 62 cases (Table 1). In addition, 14 girls had curvatures of 5–10 degrees, and two of these exceeded the threshold of 10 degrees during the follow-up period (not included in Table 1). The majority of scoliosis curves decreased during the follow-up (Table 2).

There were several cases of leg-length discrepancies in the girls with scoliosis; no case of sacral tilt without difference in leg-length was observed. The leg-length discrepancy exceeded

Table 1. Spinal deformities in 62 tall girls

Age No.	Body height (cm) Median (range)	Scolio- sis (Cobb $\leq 10^\circ$) No.	Kypho- sis ($> 40^\circ$) No.	Mb. Scheuer- mann No.
9	1 158	1	0	0
10	4 168 (163-170)	1	2	0
11	9 171 (162-178)	3	1	0
12	14 174 (171-183)	3	3	1
13	11 176 (171-181)	2	4	4
14	14 178 (174-183)	2	3	3
15	3 174 (169-177)	0	3	2
16	5 183 (177-188)	1	2	1
18	1 188	0	0	0
Total	62	13	18	11

1 cm in only one case; her scoliosis was therefore measured on a radiogram taken after compensation for this 1.5 cm difference. Six cases had leg-length discrepancies of 1.0 cm or less. Only two of these girls had a lumbar scoliosis with the convexity in the direction of the pelvic tilt which even in these cases did not seem to cause the scoliosis. The radiograms showed vertebral torsion in all cases of scoliosis.

The forward-bending test was positive in 12 cases, two of whom did not have scoliosis. In 18 girls a thoracic kyphosis of more than 40 degrees was found; only one of these girls had scoliosis but vertebral abnormalities associated with Scheuermann's disease were observed in 11 of them. In addition, one girl developed a kyphosis of 58 degrees including all the signs of

Scheuermann's disease, and also scoliosis of 12 degrees during a follow-up period of 2 years. At the primary examination she was 12 years old; she had a slight scoliosis, and kyphosis of 43 degrees without other signs of Scheuermann's disease.

A difference between skeletal age and chronological age of more than 1 year was found in five girls with scoliosis; four of these girls were skeletally immature. The median chronological age for the total sample of girls with scoliosis was 12 years 10 months and the median skeletal age was 13.0 years.

Discussion

Several authors have documented the relationship between structural scoliosis and increased growth (Skogland & Miller 1980). A sample of tall girls may be considered as a risk group and a radiographic examination was therefore found to be ethically defensible.

Even though scoliosis in adolescence is far more common in girls than in boys, the frequency (13/62) reported here is much higher than previously reported. In a school screening program in Minnesota, Lonstein et al. (1976) found an incidence of 4.3 per cent scoliosis in 40 176 girls by clinical examination.

The follow-up period in most cases was too short to tell anything about the progression tendency. However, with one exception the scoliosis curves seemed to decrease in size. In two girls the curves remained unchanged for 2

Table 2. Tall girls with a scoliosis of 10 degrees (Cobb) or more at the first examination

Chron. age years, months	Skeletal age years, months	Scoliosis Degrees	Apex Level	Side	Follow-up Degrees	Months
9,2	9,6	10	T-9	L	-	-
10,10	12,6	12	L-1	R	8	6
11,6	11	10	L-3	R	10	42
11,7	11	12	T-9	R	4	24
11,11	12	12	L-1	R	-	-
12,7	13,6	11	T-12	L	10	6
12,10	13,6	10	T-11	R	-	-
12,11	13	16	L-1	R	11	18
13,5	13,6	10	L-2	R	-	-
13,8	15	11	L-1	R	6	12
14,5	13,6	12	T-11	L	5	6
14,10	13	10	T-12	R	-	-
16,3	13	15	L-1	L	15	24

and 3.5 years. Twelve of the 13 girls with scoliosis started oestrogen treatment after the primary orthopaedic examination. This treatment retards growth and may also have caused regression or stopped progression of the deformity (Neugebauer 1974). A slight regression may also reflect a general tendency. Even though all curves measured at least 10 degrees, no curve was greater than 16 degrees and at an average age of 13 years the progression tendency is not expected to be very strong.

The incidence of postural roundback and Scheuermann's juvenile kyphosis was also abnormally high in our girls; according to Moe et al. (1978) a kyphosis of more than 40 degrees in a growing child is "abnormal". Epidemiological investigations on Scheuermann's juvenile kyphosis are sparse, the highest reported incidence being 8 per cent based on clinical examination and 6 per cent based on radiographic examination (Sørensen 1964).

The results of our small series should be interpreted with care. The major objective of the investigation was to determine the incidence of scoliosis in a selected group of girls with excessively tall stature. It would have been interesting to perform a more systematic follow-up, including a radiographic screening. For ethical reasons, however, such radiographic screening would have been questionable. Thus, only those cases were followed up in which a progression of the deformity could be suspected. Nevertheless, the high frequency of scoliosis found at the primary examination is another indicator of a close relationship between increased growth and the development of scoliosis. A similar relationship may possibly exist between growth and Scheuermann's juvenile kyphosis. Perhaps scoliosis is an additional in-

dication for oestrogen treatment of tall girls; spinal deformities should always be looked for in these cases.

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